

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-217986

(43)Date of publication of application : 31.07.2003

(51)Int.Cl. H01G 9/155  
H01G 9/02  
H01G 9/26

(21)Application number : 2002-013855

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(22)Date of filing : 23.01.2002

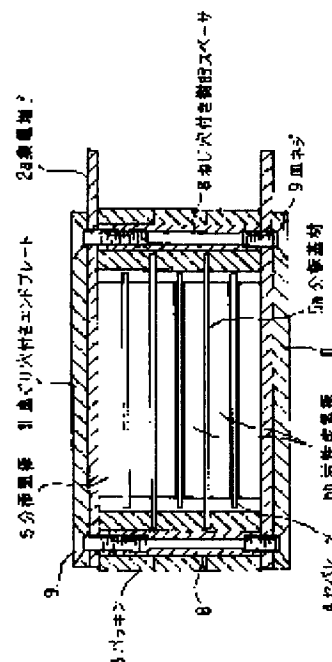
(72)Inventor : HORIKOSHI RON

## (54) LAMINATED ELECTRIC DOUBLE LAYER CAPACITOR

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a laminated electric double-layer capacitor with improved installation efficiency.

**SOLUTION:** A gel electrolytic film 4 is pinched between collection electrode plates 2, having one surfaces adhered to an active carbon electrode, and in the outer peripheral parts thereof, packings 3 having sealing function are laminated by fastening, and further these are clamped from both sides by an end plate 1, to form a capacitor unit of an airtight structure. The end plate 1 is subjected to counter sinking processing so as to make the head of a flush screw 9 fit therein, and a spacer 8 with a tapped hole is inserted between the end plates 1. The end plate 1 is screwed to the spacer 8 by the flush screw 9, thereby clamping it from both sides.



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**CLAIMS**

[Claim(s)]

[Claim 1]It laminates on both sides of packing which puts a gel electrolyte film between two collector boards which pasted up an activated carbon electrode on one side, and has a seal function in those peripheral parts, Bind these tight from both sides with an end plate, and it is considered as a capacitor unit of airtight structure, A lamination type electric double layer capacitor performing bolting from both sides by performing spot facing processing in which the head of a flat countersunk head screw is settled to said end plate, putting in a spacer with a screw hole between said end plates, and screwing said end plate on said spacer with said flat countersunk head screw.

[Claim 2]The lamination type electric double layer capacitor according to claim 1 having performed pre-insulation, having accumulated more than one on said capacitor unit as it was, having fixed to it, and considering it as a capacitor module.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to a lamination type electric double layer capacitor. In detail, it improves so that installation efficiency may be improved.

[0002]

[Description of the Prior Art]The conventional lamination type electric double layer capacitor (a capacitor is called henceforth), As shown in drawing 3, it has the polarized electrode (bipolar electrode) 5 which pasted up the activated carbon electrode to both sides of the aluminum foil substrate between the two collector boards 2 which pasted up the activated carbon electrode on one side, and bipolar structure which put by turns the gel electrolyte film 4 which has a function of a separator in piles.

The minimum unit of the gel electrolyte film 4 inserted into the activated carbon electrode which countered is called a cell.

[0003]On both sides of the rubber packing 3 which has a seal function, it has laminated so that an internal electrolyte may not begin to leak to the peripheral part of an activated carbon electrode and a collector. This packing 3 serves also as the function of an insulation to prevent from touching polarized electrode 5 comrades simultaneously. As shown in drawing 4, the cell for required withstand voltage (about 1 cell withstand voltage 2.5V) is accumulated, and it is considered as the main part 10 of a unit, and by finally binding tight from both sides with the end plate 1, airtight structure is maintained, welding pressure is applied to the inside of a cell, and it assembles as a capacitor unit.

[0004]If a lamination type capacitor unit attaches a lead to the terminal area (collecting terminals) 2a of the collector board 2, it serves as a series connection within a unit, and will have the withstand voltage of only  $x$  (1 cell withstand voltage) (the number of cell laminations). This lamination type capacitor unit does not need a cable etc. as compared with the capacitor of the same capacity using a general rolling-up method, but since withstand voltage can design highly compactly, it can make an installation body product small.

[0005]

[Problem(s) to be Solved by the Invention]The conventional lamination type electric double layer capacitor unit mentioned above is bound tight with the bolt 7 via the insulating spacer 6 across unit both sides with the end plates 1a and 1b, in order to acquire the application of pressure between cells, and the seal force of the packing 3, as shown in drawing 5. The polarized electrode 5 is the structure which pasted up the activated carbon electrode 5b on both sides of the polarization substrate 5a. To the end plate 1a on top, the KIRI hole is open, the insulating spacer 6 is attached to the hole, and it is letting the clamping bolt 7 pass.

[0006]To the end plate 1b at the bottom, the screw hole is open, on the other hand, and the application of pressure and the seal of the capacitor unit are performed. [ by screwing the clamping bolt 7 on this screw hole ] The clamping bolt 7 will project at such a lamination type capacitor unit on the upper surface and the undersurface of the end plates 1a and 1b, When two or more capacitor units were put in order, the bolt portion which projected became a dead space

as it is, and there was a problem of reducing volume energy density.

[0007]

[Means for Solving the Problem] A lamination type electric double layer capacitor concerning claim 1 of this invention which solves an aforementioned problem, It laminates on both sides of packing which puts a gel electrolyte film between two collector boards which pasted up an activated carbon electrode on one side, and has a seal function in those peripheral parts, Bind these tight from both sides with an end plate, and it is considered as a capacitor unit of airtight structure, Bolting is performed from both sides by performing spot facing processing in which the head of a flat countersunk head screw is settled to said end plate, putting in a spacer with a screw hole between said end plates, and screwing said end plate on said spacer with said flat countersunk head screw.

[0008] Pre-insulation was performed, and more than one were accumulated on said capacitor unit indicated to claim 1 as it was, it fixed to it, and a lamination type electric double layer capacitor concerning claim 2 of this invention which solves an aforementioned problem was taken as a capacitor module.

[0009]

[Embodiment of the Invention][Example 1] The lamination type electric double layer capacitor concerning one example of this invention is shown in drawing 1. This example is the installation improvement-in-efficiency type capacitor unit which raised volume energy density. Identical codes are given to conventional technology and identical parts, and explanation is omitted. Bolting [ unit both sides ] using the end plate 11 of aluminum as well as the former as shown in drawing 1, in order to acquire the welding pressure and seal force between cells. Spot facing processing is performed to the end plate 11 so that the head of the flat countersunk head screw 9 may be settled.

[0010] The hole which lets the spacer 8 made of resin pass is made in the packing 3 between the end plates 11. The spacer 8 made of resin is the construction material which does not deteriorate with the electrolysis solution used for the capacitor, and intensity and insulation are required, and the product made from PPS (polyphenylene sulfide) which is easy to come to hand is suitable. Screw hole processing is performed to SUBESA 8 made of resin, and it is made a little shorter than the width of a unit. The length of the flat countersunk head screw 9 chooses the thing of length which does not contact mutually, when a unit is bound tight from both sides.

[0011] Bolting by inserting the spacer 8 made of resin in the packing 3 between the end plates 11, putting from both sides with the end plate 11, penetrating the end plate 11, and thrusting the flat countersunk head screw 9 into the spacer 8. In this example, the end plate 11 which a screw hole 4 mm in diameter opened was used to 8 mm of spacer outsides. Since the head of the flat countersunk head screw 9 is restored to the spot facing hole of the end plate 11, the flat countersunk head screw 9 stops, as for the capacitor unit made into such a bolting structure, projecting from the end plate 11. Therefore, except a terminal area, it becomes perfect cube (cubicle switch gear) shape, and the volume energy density of a unit improves.

[0012] As explained in this way, in this example, by considering it as the structure where the flat countersunk head screw 9 which is a clamping bolt does not project from the end plate 11, it can be considered as perfect cubicle-switch-gear shape, and the volume energy density of a unit improves. Specifically by this example, volume energy density was able to be raised 30%. It can do [ making into the same thing the end plate 11 used for capacitor unit both sides, or ], and a cost cut can be aimed at by deletion of a component type.

[0013][Example 2] The 2nd example of this invention is shown in drawing 2 (a) and (b). This example is a case where two or more above-mentioned capacitor units are installed. That is, as shown in drawing 2 (a), the heat-shrinkable tubing 21 for the prevention from an electric shock / short circuit is put on the capacitor unit 20, and it puts in and heats in a homoiothermal layer (graphic display abbreviation), and it is made to contract and the tube 21 is stuck. The product made from vinyl chloride contracted below 80 \*\* which, as for the heat-shrinkable tubing 21, damage \*\*\*\* does not have in the capacitor unit 20 is suitable. As shown in a quantity pile required as it is and drawing 2 (b), it binds and fixes in the resin band 22, and let the capacitor unit 20 which performed such pre-insulation be a capacitor module.

[0014] This capacitor module is put into the rack (graphic display abbreviation) constructed by the easy metal angle, and it fixes within apparatus. By performing pre-insulation by the heat-shrinkable tubing 21 to the capacitor unit 20 in this example, as explained in this way, and fixing with the pile resin band 22 as it is. Unit installation efficiency improves more nearly substantially than before, and it becomes possible to store the capacitor system of identical performance in fewer spaces. Specifically by this example, the installing space of the unit was able to be reduced 25% as compared with the former.

[0015]

[Effect of the Invention] As mentioned above, as it explained concretely based on the example, in this invention, by considering it as the structure where a clamping bolt does not project from an end plate, it can be considered as perfect cubicle-switch-gear shape, and the volume energy density of a unit improves. It can do [making into the same thing the end plate used for unit both sides, or ], and a cost cut can be aimed at by deletion of a component type. Pre-insulation is performed to the above-mentioned capacitor unit, unit installation efficiency improves by putting as it is and fixing more nearly substantially than before, and it becomes possible to store the capacitor system of the same performance in fewer spaces.

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**TECHNICAL FIELD**

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PRIOR ART

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**EFFECT OF THE INVENTION**

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]The conventional lamination type electric double layer capacitor unit mentioned above is bound tight with the bolt 7 via the insulating spacer 6 across unit both sides with the end plates 1a and 1b, in order to acquire the application of pressure between cells, and the seal force of the packing 3, as shown in drawing 5. The polarized electrode 5 is the structure which pasted up the activated carbon electrode 5b on both sides of the polarization substrate 5a. To the end plate 1a on top, the KIRI hole is open, the insulating spacer 6 is attached to the hole, and it is letting the clamping bolt 7 pass.

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MEANS

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**DESCRIPTION OF DRAWINGS**

[Brief Description of the Drawings]

[Drawing 1]It is a sectional view showing the installation improvement-in-efficiency type capacitor unit concerning one example of this invention.

[Drawing 2]It is a lineblock diagram showing the capacitor module concerning the 2nd example of this invention.

[Drawing 3]It is a basic constitution figure showing a lamination type capacitor unit.

[Drawing 4]It is bolting structural drawing of a capacitor unit.

[Drawing 5]It is a sectional view of the conventional capacitor unit.

[Description of Notations]

- 1, 1a, 1b, and 11 End plate
- 2 Collector board
- 3 Rubber packing
- 4 Gel electrolyte film
- 5 Polarized electrode
- 6 Insulating spacer
- 7 Clamping bolt
- 8 The spacer made of resin
- 9 Flat countersunk head screw
- 10 The main part of a unit
- 20 Capacitor unit
- 21 Heat-shrinkable tubing
- 22 Resin band

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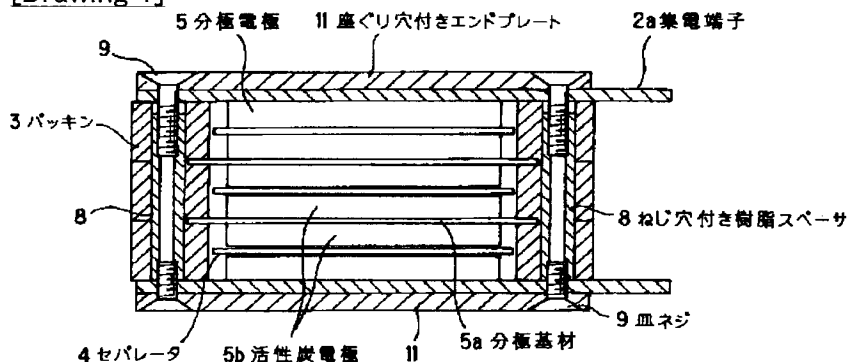
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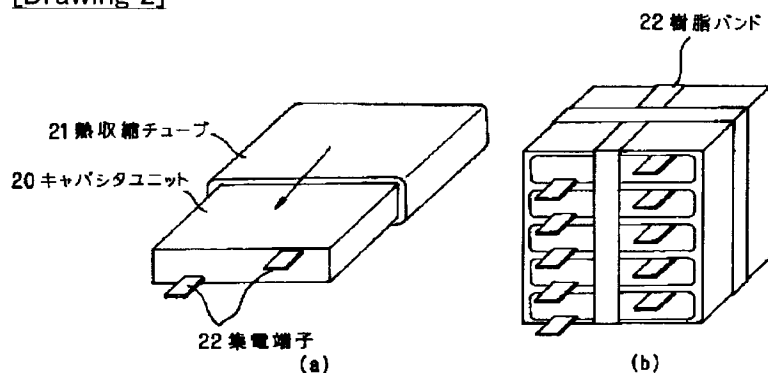
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## DRAWINGS

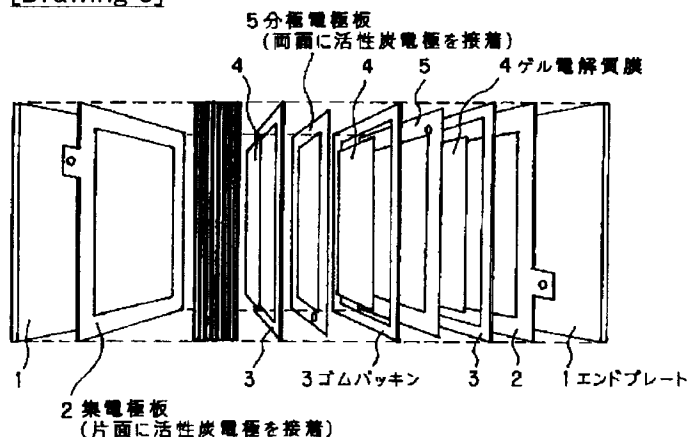
[Drawing 1]



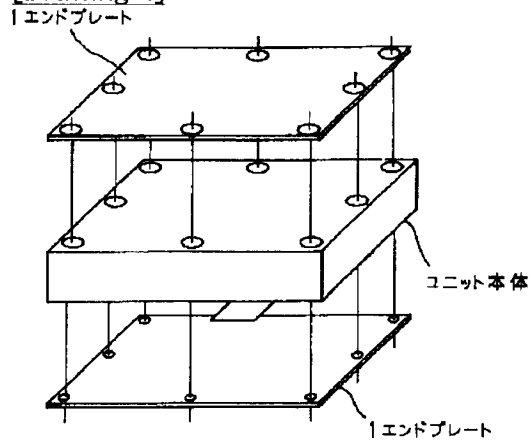
[Drawing 2]



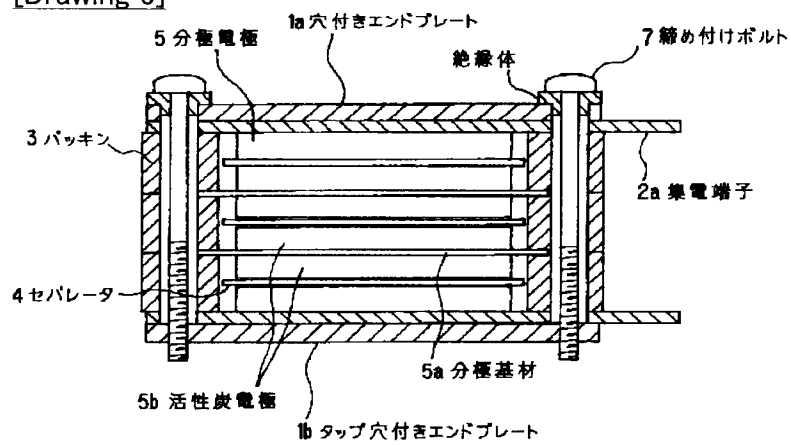
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2003-217986

(P2003-217986A)

(43) 公開日 平成15年7月31日 (2003.7.31)

(51) Int.Cl. <sup>7</sup>	識別記号	F I	テーマコード* (参考)
H 0 1 G	9/155	H 0 1 G	9/00
	9/02		3 0 1 J
	9/26		3 0 1 C
			5 2 1

審査請求 未請求 請求項の数 2 O L (全 5 頁)

(21) 出願番号 特願2002-13855 (P2002-13855)

(22) 出願日 平成14年1月23日 (2002.1.23)

(71) 出願人 000006105

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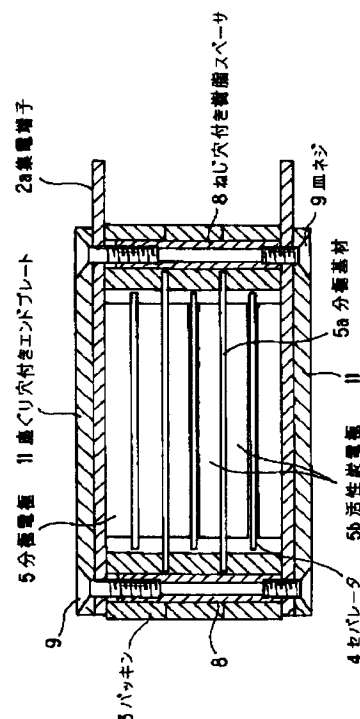
弁理士 光石 俊郎 (外2名)

(54) 【発明の名称】 積層型電気二重層キャパシタ

(57) 【要約】

【課題】 設置効率を改善した積層型電気二重層キャパシタを提供するにある。

【解決手段】 片面に活性炭電極を接着した集電極板2間にゲル電解質膜4を挟み込みそれらの外周部にはシール機能を有するパッキン3を挟んで積層し、更にこれらをエンドプレート1で両側から締め付けて密閉構造のキャパシタユニットとし、前記エンドプレート1には皿ネジ9の頭が収まる座ぐり加工を施し、前記エンドプレート1間にネジ穴付きスペーサ8を入れ、前記エンドプレート1を前記皿ネジ9で前記スペーサ8に螺着することにより、両側から締め付けを行うことを特徴とする。



**【特許請求の範囲】**

【請求項1】 片面に活性炭電極を接着した2枚の集電極板間にゲル電解質膜を挟み込みそれらの外周部にはシール機能を有するパッキンを挟んで積層し、更にこれらをエンドプレートで両側から締め付けて密閉構造のキャパシタユニットとし、前記エンドプレートには皿ネジの頭が収まる座ぐり加工を施し、前記エンドプレート間にネジ穴付きスペーサを入れ、前記エンドプレートを前記皿ネジで前記スペーサに螺着することにより、両側から締め付けを行うことを特徴とする積層型電気二重層キャパシタ。

【請求項2】 前記キャパシタユニットに絶縁被覆を施してそのまま複数積み重ねて固定しキャパシタモジュールとしたことを特徴とする請求項1記載の積層型電気二重層キャパシタ。

**【発明の詳細な説明】****【0001】**

【発明の属する技術分野】 本発明は、積層型電気二重層キャパシタに関する。詳しくは、設置効率を改善するように改良したものである。

**【0002】**

【従来の技術】 従来の積層型電気二重層キャパシタ（以後キャパシタと呼称する）は、図3に示すように、片面に活性炭電極を接着した2枚の集電極板2の間に、アルミ箔基材の両面に活性炭電極を接着した分極電極（中間電極）5とセパレータの機能を有するゲル電解質膜4を交互に重ねて挟み込んだバイポーラ構造となっており、対向した活性炭電極に挟まれるゲル電解質膜4の最小単位をセルと呼称する。

【0003】 活性炭電極、集電極の外周部には内部の電解質が漏れ出さないように、シール機能を有するゴムパッキン3を挟んで積層している。このパッキン3は同時に分極電極5同士が触れないようにする絶縁の機能も兼ねている。更に、図4に示すように、必要な耐電圧分のセル（1セル耐電圧2.5V程度）を積み重ねてユニット本体10とし、最後にエンドプレート1で両側から締め付けることにより密閉構造を保ち、セル内部に加圧力を加え、キャパシタユニットとして組み立てる。

【0004】 積層型キャパシタユニットは、集電極板2の端子部（集電端子）2aにリード線を取り付けられ、ユニット内で直列接続となり、（1セル耐電圧）×（セル積層数）だけの耐電圧を持つことになる。この積層型キャパシタユニットは、一般的な巻き取り方式を用いた同一容量のキャパシタと比較してケーブル等を必要とせず、コンパクトに耐電圧が高く設計できるため設置体積を小さくすることができる。

**【0005】**

【発明が解決しようとする課題】 上述した従来の積層型電気二重層キャパシタユニットは、図5に示すように、セル間の加圧とパッキン3のシール力を得るために、ユ

ニット両面をエンドプレート1a、1bで挟み絶縁スペーサ6を介してボルト7で締め付けている。分極電極5は分極基材5aの両面に活性炭電極5bを接着した構造である。上面のエンドプレート1aにはキリ穴が開いており、その穴に絶縁スペーサ6を取り付け、締め付けボルト7を通してある。

【0006】 一方、下面のエンドプレート1bにはネジ穴が開いており、このネジ穴に締め付けボルト7を螺着して締め付けを行い、キャパシタユニットの加圧及びシールを行っている。このような積層型キャパシタユニットには、エンドプレート1a、1bの上面及び下面に締め付けボルト7が突き出すことになり、複数のキャパシタユニットを並べた場合、突き出たボルト部分がそのままデッドスペースとなってしまう、体積エネルギー密度を低下させてしまうという問題があった。

**【0007】**

【課題を解決するための手段】 上記課題を解決する本発明の請求項1に係る積層型電気二重層キャパシタは、片面に活性炭電極を接着した2枚の集電極板間にゲル電解質膜を挟み込みそれらの外周部にはシール機能を有するパッキンを挟んで積層し、更にこれらをエンドプレートで両側から締め付けて密閉構造のキャパシタユニットとし、前記エンドプレートには皿ネジの頭が収まる座ぐり加工を施し、前記エンドプレート間にネジ穴付きスペーサを入れ、前記エンドプレートを前記皿ネジで前記スペーサに螺着することにより、両側から締め付けを行うことを特徴とする。

【0008】 上記課題を解決する本発明の請求項2に係る積層型電気二重層キャパシタは、請求項1に記載した前記キャパシタユニットに絶縁被覆を施してそのまま複数積み重ねて固定しキャパシタモジュールとしたことを特徴とする。

**【0009】**

【発明の実施の形態】 〔実施例1〕 本発明の一実施例に係る積層型電気二重層キャパシタを図1に示す。本実施例は、体積エネルギー密度を向上させた設置効率改善型キャパシタユニットである。尚、従来技術と同一部分には同一符号を付して説明を省略する。図1に示すように、セル間の加圧力及びシール力を得るために、従来と同じくアルミニウムのエンドプレート11を用いてユニット両面の締め付けを行う。エンドプレート11には皿ネジ9の頭が収まるように座ぐり加工を施しておく。

【0010】 エンドプレート11間のパッキン3には、樹脂製スペーサ8を通す穴を開けておく。樹脂製スペーサ8はキャパシタに用いている電解液で劣化しない材質で、かつ強度、絶縁性が要求され、入手しやすいPPS（ポリフェニレン・サルファイド）製が適している。また、樹脂製スペーサ8にはネジ穴加工が施されており、ユニットの幅よりもやや短くしておく。皿ネジ9の長さ、ユニットを両側から締め付けた時お互いに接触しな



い長さのものを選択する。

【0011】エンドプレート11間のパッキン3に樹脂製スペーサ8を挿入し、エンドプレート11で両側から挟み込み、エンドプレート11を貫通して皿ネジ9をスペーサ8にねじ込むことにより、締め付けを行う。本実施例では、スペーサ外形8mmに対して、直径4mmのネジ穴が開いたエンドプレート11を使用した。このような締め付け構造としたキャパシタユニットは、エンドプレート11の座ぐり穴に皿ネジ9の頭が納まるため、皿ネジ9がエンドプレート11から突出しなくなる。そのため、端子部以外は完全な立方体（キュービカル）形状となり、ユニットの体積エネルギー密度が向上する。

【0012】このように説明したように本実施例では、エンドプレート11から締め付けボルトである皿ネジ9が突出しない構造とすることで、完全なキュービカル形状とする事ができ、ユニットの体積エネルギー密度が向上する。具体的には、本実施例では、体積エネルギー密度を30%向上させることができた。また、キャパシタユニット両面に用いるエンドプレート11を同一のものとすることかでき、部品種類の削除によりコストダウンが図れる。

【0013】〔実施例2〕本発明の第2の実施例を図2（a）（b）に示す。本実施例は、上記キャパシタユニットを複数設置する場合である。即ち、図2（a）に示すように、キャパシタユニット20に感電・短絡防止用の熱収縮チューブ21を被せて恒温層（図示省略）に入れ、加熱してチューブ21を収縮させ密着させる。熱収縮チューブ21は、キャパシタユニット20にダメージ与えない80℃以下で収縮する塩化ビニール製が適している。このような絶縁被覆を施したキャパシタユニット20をそのまま必要な数量積み重ね、図2（b）に示すように、樹脂バンド22で縛り固定してキャパシタモジュールとする。

【0014】このキャパシタモジュールを簡単な金属アングルで組んだラック（図示省略）に入れ機器内で固定する。このように説明したように本実施例では、キャパシタユニット20に熱収縮チューブ21による絶縁被覆を施して、そのまま積み重ね樹脂バンド22により固定することで、従来よりも大幅にユニット設置効率が向上

し、より少ないスペースに同一性能のキャパシタシステムを収めることが可能となる。具体的には、本実施例では、ユニットの設置スペースを従来に比較して25%低減させることができた。

#### 【0015】

【発明の効果】以上、実施例に基づいて具体的に説明したように、本発明では、エンドプレートから締め付けボルトが突出しない構造とすることで、完全なキュービカル形状とする事ができ、ユニットの体積エネルギー密度が向上する。また、ユニット両面に用いるエンドプレートを同一のものとする事かでき、部品種類の削除によりコストダウンが図れる。更に、上記キャパシタユニットに絶縁被覆を施して、そのまま積み重ね固定することで、従来よりも大幅にユニット設置効率が向上し、より少ないスペースに同一性能のキャパシタシステムを収めることが可能となる。

#### 【図面の簡単な説明】

【図1】本発明の一実施例に係る設置効率改善型キャパシタユニットを示す断面図である。

【図2】本発明の第2の実施例に係るキャパシタモジュールを示す構成図である。

【図3】積層型キャパシタユニットを示す基本構成図である。

【図4】キャパシタユニットの締め付け構造図である。

【図5】従来のキャパシタユニットの断面図である。

#### 【符号の説明】

1, 1a, 1b, 11 エンドプレート

2 集電極板

3 ゴムパッキン

4 ゲル電解質膜

5 分極電極

6 絶縁スペーサ

7 締め付けボルト

8 樹脂製スペーサ

9 皿ネジ

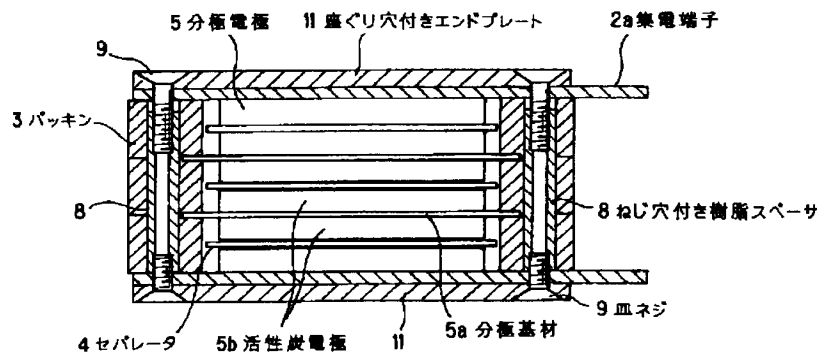
10 ユニット本体

20 キャパシタユニット

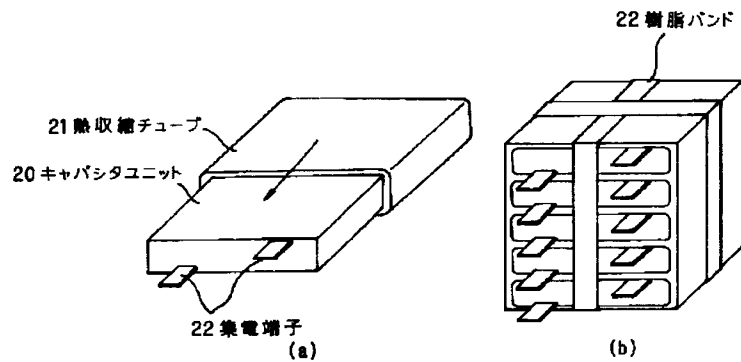
21 熱収縮チューブ

22 樹脂バンド

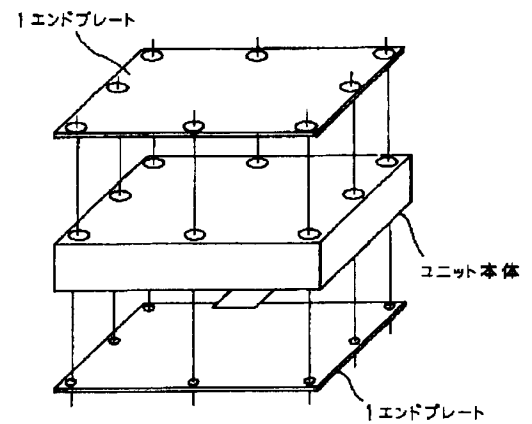
【図1】



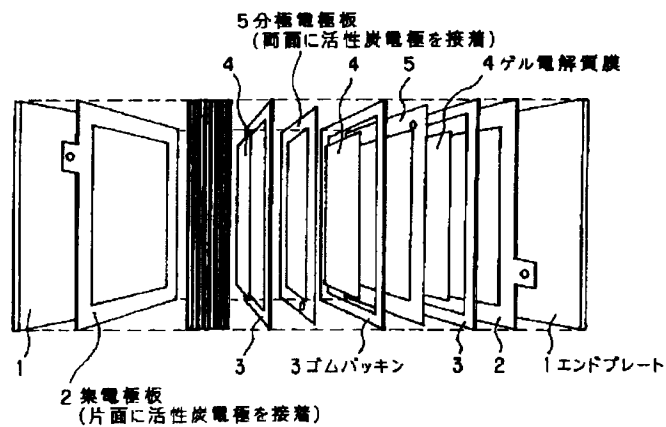
【図2】



【図4】



【図3】



【図5】

